

Photonic crystal characterization using out of plane scattering

¹B. Lombardet, ¹L. A. Dunbar, ²R. Ferrini, ¹R. Houdré, ³G-H. Duan and ⁴F. Robin

¹Institut de Photonique et d'Electronique Quantique, ²Laboratory of Optoelectronics of Molecular Materials, Ecole Polytechnique Fédérale de Lausanne, CH-1015 Lausanne, Switzerland. ³Opto+, Alcatel Research & Innovations, Route de Nozay, F-91460 Marcoussis, France. ⁴Electronics Laboratory, Swiss Federal Institute of Technology, Zurich, Switzerland.

An experimental technique to investigate the optical properties of two-dimensional Photonic Crystals (PhCs) will be presented. Light that is scattered out of the propagation plane is normally viewed as an unwanted effect in PhCs as it leads to propagation losses. However, this scattered light is strongly correlated with the light propagating in the PhC and can be used to obtain information about the optical field inside the PhC. The intensity and polarisation of this scattered light can be measured and the properties of the propagating light can be deduced. This technique can give a wide variety of information. In particular, the influence of the position of the propagating modes with respect to the folded air-light cone can be studied. We will present two examples. First, by studying the properties of the Fabry-Pérot-like mode scattered from a single line defect in a PhC waveguide, propagation losses were deduced from the attenuated diffracted light and compared to theoretical predictions. Second, by collecting the scattered light, a 'map' of the optical field inside a self-collimating structure was studied. The divergence of the beam was measured as a function of energy and compared to the results of equi-frequency analysis.

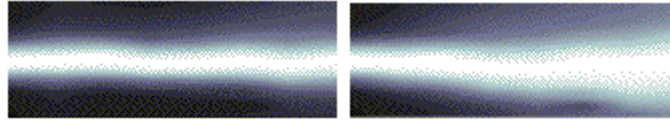


Fig. 1: Light scattered out-of-plane at different energies in a self-collimating PhC structure: (a) $u=a/\lambda=0.300$ (self-collimated beam) and (b) $u=a/\lambda=0.303$ (divergent beam)